An Ontological Framework for Contextualising Information in Hypermedia Systems.

by

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student

Dedication

This thesis, and the work that went in to it, is dedicated to Anthony & Margaret Bucknell – Mum & Dad. Your love, support and belief made it possible for me to persevere and succeed. For that, I am eternally grateful.

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Abstract

The Internet has become part of everyday modern life. A central component of the Internet is the World Wide Web. With hundreds of millions of users trying to find information they need amongst billions of pages, there is an urgent need for tools that help users find the information they need. A key element in assisting users find information is their context. Being able to model and store a user's context provides information about the user that can be used to augment their information-seeking behaviours. This work investigated the hypothesis that it is possible to create an ontology of context that can be used to create tools that users perceive to be useful and easy to use when performing information-seeking behaviours on the World Wide Web.

This hypothesis was investigated through three research stages. First, a concept of context was developed that applies to information-seeking behaviours on the World Wide Web. Next, this concept was modelled using an ontology, and a software framework was created based on this ontology. This framework was used to create tools that augment the information-seeking behaviours of users of the World Wide Web. Finally, an empirical evaluation of these tools was performed to determine if they were perceived to be useful and easy to use. The results of the evaluation indicate that the tools constructed were perceived to be useful and easy to use, providing evidence that supports the validity of the hypothesis. This outcome encourages further research and development into using an ontology of context to develop tools that help people using the World Wide Web to find the information that they need.

Extended Abstract

While context is an integral part of interacting with information, existing approaches to managing contextual information on the World Wide Web are application specific and do not support sharing contextual information. The consequence of this is that the contextual information in each application is stored in a way that is specific to that application, and the reuse of information between tools is not explicitly supported. This lack of explicit support for sharing contextual information between applications limits the effectiveness of tools that contextualise information. This thesis demonstrates that an open model of context can be used across applications to contextualise information, and that users find tools based on this approach to contextualisation to be useful.

This hypothesis for this research states that *it is possible to create an ontology of context that can be used to create tools that users perceive to be useful and easy to use when performing information-seeking behaviours on the World Wide Web.* This hypothesis is investigated through three research stages: development of a concept of context that is application neutral; demonstration that this concept of context can be used to contextualise information on the World Wide Web; an empirical evaluation that shows that it is possible to create useful tools using this model.

The concept of context was developed by undertaking a critical analysis of the literature and using this to explicitly identify the role of the user's context in information-seeking behaviours on the World Wide Web. This concept is developed over two phases of investigation. The first phase reviews hypermedia models and systems, including the World Wide Web, to identify the goals of hypermedia and the approaches to information management that are used to achieve these goals. This review identifies the interaction of a user with web resources in producing information as being fundamental to

hypermedia. The next phase of the critical analysis builds on this understanding of hypermedia to develop a concept of context that explicitly includes data about the user as a construct a user's interaction with web resources.

Demonstrating the use of the concept of context to contextualise information on the World Wide Web involved two phases of research. The research in the first phase shows how the concepts expressed in the concept of context can be represented using the Web Ontology Language. The second phase develops a software framework based on the ontology of context that can be used to identify, collect and use contextual information. This framework, the ICU framework, encompasses existing approaches to contextualisation while also providing an open architecture based on web services that can be used to make contextual information available to applications that contextualise information. The utility of this framework is demonstrated by constructing a tool that implements existing contextualisation interfaces in a single tool, using the one collection of contextual information. This tool is called ISeeYou.

The empirical evaluation used the Technology Acceptance Model (TAM) to investigate the usefulness and ease-of-use of ISeeYou for users engaging in their regular information-seeking behaviours on the World Wide Web. TAM has been shown to be effective in evaluating the usefulness and ease-of use of new technologies, and has been successfully applied to evaluating web-based technologies. The results of this evaluation indicate that tools based on the framework and the ontology are useful and easy-to-use when performing information-seeking behaviours on the World Wide Web. This outcome encourages the further development of tools that use the ICU framework and further development of ontologies that represent the context of users of the World Wide Web.

This research investigated an approach to managing contextual information that allows reuse of contextual information by using an open architecture and offers a richer set of contextual information by structuring the information using an ontology. By creating an open shareable model of context, the constraints on using contextual information across different contextualisation tools is removed and richer tools for contextualising information on the World Wide Web can be created. This research is predicated on the belief that contextualisation of information on the World Wide Web is an essential tool for helping users manage information, and the development of tools that perform contextualisation is an ongoing challenge for researchers and developers. The ontology and the framework developed in this work aim to help meet this challenge. The research carried out in this work demonstrates that it is possible to create an ontology of context that can be used to create tools that users perceive to be useful and easy to use when performing information-seeking behaviours on the World Wide Web. This result encourages further research in to an ontology-based model of context that explicitly is focussed on the user.